(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 750 642 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.12.2020 Bulletin 2020/51

(51) Int Cl.:
B08B 5/02 *(2006.01)* ***B05B 14/10*** *(2018.01)*
B65G 45/22 *(2006.01)*

(21) Application number: **20179834.5**

(22) Date of filing: **12.06.2020**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **14.06.2019 IT 201900009030**

(71) Applicant: **Olpidürr S.P.A.**
20090 Segrate (MI) (IT)

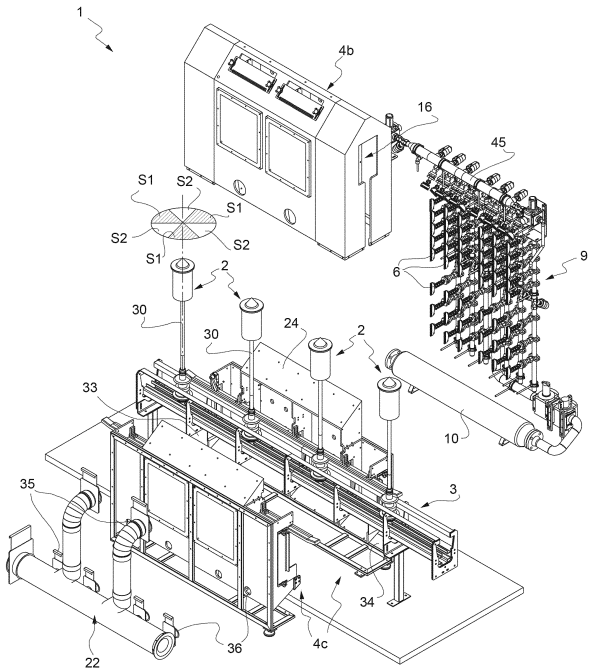
(72) Inventors:
- **PEDRUZZI, Patric**
24043 CARAVAGGIO (BG) (IT)
- **PIZZAMIGLIO, Marco Pierluigi**
20090 SEGRATE (MI) (IT)

(74) Representative: **Plebani, Rinaldo et al**
Studio Torta S.p.A.
Via Viotti, 9
10121 Torino (IT)

(54) DEVICE AND METHOD FOR CLEANING PAINTING SPINDLES FOR VEHICLE WHEELS

(57) Cleaning of painting spindles (2), wherein a lower end (50) of the spindles is engaged on a conveyor (3), which feeds them along a cleaning chamber (5), which is provided with blowing nozzles (6), and along a first and a second pre-chamber (11, 12), which are arranged in series upstream and downstream of the cleaning chamber, inlet and outlet openings (13, 15) of the cleaning chamber (5) being closed by first squeegee blades (18) shaped like foils or brushes, and through inlet and outlet slits of the pre-chambers provided with air curtain seals; the nozzles being divided into a first and a second bench (41, 42) spaced apart from one another with a pitch that is such that the first bench sends compressed air on first angular sectors (S1) of the spindles, whereas the second bench sends compressed air on second angular sectors (S2) of the spindles.

FIG. 2



EP 3 750 642 A1

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 102019000009030 filed on 14/06/2019.

TECHNICAL FIELD OF THE INVENTION

[0002] The invention relates to a device and a method for cleaning painting spindles, known in technical jargon as "stakes", which are used to support wheel rims while the wheel rims themselves undergo powder coating operations, to which, in particular, light alloy wheel rims are subjected.

BACKGROUND ART

[0003] Wheel rims normally consist of an outer ring, which is U-shaped in radial section an on which, in use, the tyres are mounted, of an intermediate part, which usually consists of a plurality of radial spokes, and of a central annular element or hub, which is delimited by a front annular surface, which, in use, comes into contact with the wheel hub unit of the vehicle and needs to remain as raw as possible in order to allow for a good friction coupling to the wheel hub unit.

[0004] Both for aesthetic and technological reasons, vehicle wheel rims and, in particular, wheel rims made of light alloys, need to be painted and the painting process most commonly used is powder coating, during which powder paint is sprayed against the rim and then cured.

[0005] This type of painting process is carried out supporting each rim by means of a respective spindle, which consists of a stem provided, at an upper end thereof, with a conical head projecting from a plate or flange and, at a lower end thereof, with a holding device, which is configured to engage a conveyor, usually a belt or chain conveyor.

[0006] Each wheel rim is laid on the plate or flange by means of the front annular surface of the central annular element, which engages, with a radially inner side wall thereof, the conical head, so that the outer ring or "rim" is supported in a radially projecting manner by the spindle, together with the spokes.

[0007] Once each spindle is coupled to a conveyor, the wheel rims are caused to go through a painting cabin, where they are painted, in order to then be cured.

[0008] However, during the powder coating operation, the spindles receive a part of the paint as well, which, despite not perfectly adhering to them, dirties them to such an extent that they absolutely need to be cleaned in order to remove residues of powder paint before being used in a new painting process.

[0009] Removing said powder paint is not a simple task; as a matter of fact, the paints used for wheel rim painting are highly inflammable, so that it is impossible to use metal brushes or any other tool that can produce sparks in contact with the spindles. The use of soft brushes, for example made of felt or rubber, does not solve the problem of cleaning the spindles in a quick, efficient and economic fashion; as a matter of fact, the brushes get dirty very quickly and, hence, need to be manually cleaned. The use of compressed air cleaning devices is dangerous, for even the smallest quantity of paint should carefully be prevented from being released into the atmosphere, both for obvious pollution reasons and, especially, for the risk of formation of explosive mixtures.

DISCLOSURE OF INVENTION

[0010] The object of the invention is to provide a device and a method for cleaning painting spindles for the support of wheel rims, which are not affected by the drawbacks of the prior art and, in particular, allow for quick treatments, have small usage costs and small dimensions and ensure a high safety of use, in particular when it comes to the risk of explosions, as well as a high cleaning efficiency.

[0011] Therefore, according to the invention there are provided a device and a method for cleaning painting spindles for the support of wheel rims having the features set forth in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Further features and advantages of the invention will be best understood upon perusal of the following description of a non-limiting embodiment thereof, made by mere way of example, with reference to the accompanying drawings, wherein:

- figure 1 schematically shows a three-quarter perspective front view of a cleaning device according to the invention;
- figure 2 schematically shows an exploded three-quarter perspective rear view of the cleaning device of figure 1;
- figure 3 schematically shows, on a larger scale, a three-quarter perspective rear view, longitudinally cross-sectioned, of a first terminal end of the cleaning device of figures 1 and 2;
- figure 4 schematically shows, on a larger scale, a cross-sectional elevation view of the cleaning device of figures 1 and 2;
- figure 5 schematically shows, on a smaller scale compared to figure 3, an elevation view, longitudinally cross-sectioned, of the cleaning device of figures 1 and 2;
- figure 6 schematically shows, on a smaller scale compared to figure 5, a three-quarter perspective rear view, longitudinally cross-sectioned, of the cleaning device of figures 1 and 2;
- figure 7 shows, on a larger scale, a three-quarter perspective front view, cross-sectioned, of a detail

of the cleaning device of figures 1 and 2; and

- figure 8 shows, on a larger scale, a three-quarter perspective front view of a detail of a second terminal end, opposite the first terminal end of figure 3, of the cleaning device of figures 1 and 2.

DETAILED DESCRIPTION

[0013] With reference to figures 1 to 8, number 1 indicates, as a whole, a device for cleaning painting spindles 2.

[0014] The spindles 2 are used, in a known manner, to support wheel rims during a wheel rim powder coating operation. During this operation, the spindles receive part of the powder paint, which, hence, needs to be removed after the painting operation.

[0015] This removal takes place by means of the device 1, which is described below, so that the spindles enter the device 1 immediately after the painting operation, once the wheel rims they supported have been removed, and then can be used again when they get out of the device 1.

[0016] The cleaning device 1 comprises a conveyor 3, which is configured to engage and transport a plurality of spindles 2 arranged in sequence along a predetermined trajectory, in the non-limiting example shown herein a straight trajectory.

[0017] The device 1 further comprises a casing 4, which is made of a fireproof plastic material coated with a sheet metal cover, so as to avoid the build-up of electrostatic charges coming from the environment where it is installed, and delimits, on the inside, a cleaning chamber 5 (figure 5), through which the conveyor 3 is arranged in such a way that, in use, the spindles 2 travel, in sequence, through the cleaning chamber 5 along the aforesaid predetermined direction, which is defined by a longitudinal development of the conveyor 3, which is straight.

[0018] The device 1 also comprises a plurality of nozzles 6, which are arranged inside the cleaning chamber 5 and are oriented towards the conveyor 4 and the spindles 2 transported by it.

[0019] The nozzles 6 (figure 7) have a fan shape, are flat and are each supported by a swivelling joint 7, which, in turn, is supported by the casing 4, so that they can be oriented according to the single needs. Generally speaking, they are oriented, thanks to the swivelling joints 7, so as to copy, on a same side of the spindles 2, a peripheral cross profile of the spindles 2 themselves. Furthermore, the nozzles 6 can be provided with brushes 8 (figure 3), which are configured to cooperate in contact, in use, with the spindles 2.

[0020] The device 1 finally comprises a compressed air feeding plant 9 to feed compressed air to the nozzles 6, which is provided with a tank 10, which is housed in the casing 4, under the cleaning chamber 5.

[0021] According to a first aspect of the invention, the device 1 comprises a first pre-chamber 11 and a second pre-chamber 12, which are delimited by the casing 4 and are arranged in series to the cleaning chamber 5, said pre-chambers 11, 12 being crossed in series by the conveyor 3 (figure 5).

[0022] The first pre-chamber 11 is arranged in the area of an inlet opening 13 of the cleaning chamber 5, with which it is in hydraulic communication, and is provided, in turn, with an inlet slit 14, which is crossed by the conveyor 3.

[0023] Similarly, the second pre-chamber 12 is arranged in the area of an outlet opening 15 of the cleaning chamber 5, with which it is in hydraulic communication, and is provided, in turn, with an outlet slit 16, which is crossed by the conveyor 3.

[0024] According to an aspect of the invention, the inlet 13 and outlet 15 openings of the cleaning chamber 5 are each closed by at least one pair of flexible and elastically deformable first squeegee blades/brushes or straps 18 (figure 3), which are made of a preferably non-sparking and fireproof synthetic or elastomer plastic material, such as a polyamide 6 filled with a flame retardant, are arranged side by side, adjacent or overlapped, are shaped like brushes or foils and are configured to cooperate in contact with each one of the spindles 2 so as to be deformed by them while the spindles 2 cross the inlet and outlet openings 13, 15 and, at the same time, brush the spindles 2.

[0025] According to another aspect of the invention and in combination with the squeegee blades 18, the inlet and outlet slits 14, 16 of the pre-chambers 11, 12 are each provided, on the other hand, with a respective air curtain double seal C1, C2 (figure 5), which is provided/created, for example, by respective nozzles 19 (figures 5 and 8).

[0026] Finally, according to another aspect of the invention, the cleaning chamber 5 and the pre-chambers 11, 12 are connected, in the area of respective lower ends thereof, 20 for the chamber 5 and 21 for the pre-chambers 11, 12 (figures 3, 5), with an air suction plant 22 (figures 2, 4), which is also part of the device 1.

[0027] According to an aspect of the invention, the plant 22 is configured to suck a quantity of air which is greater than the one introduced into the chamber 5 by the nozzles 6. In particular, the plant 22 is sized so as to suck an air volume ranging from 2500 to 4000 m^3/h, hence significantly greater than the one fed to the nozzles 6, namely produced by the plant 9. In this way, the chambers 5, 11 and 12 are substantially kept under vacuum.

[0028] According to a further aspect of the invention, the cleaning chamber 5 (figures 4 and 7) is divided into an upper compartment 23 and a lower compartment defining/making up the lower end 20 of the cleaning chamber 5.

[0029] The upper compartment 23 is delimited, at the bottom, by a respective first bottom wall 24 and the lower compartment 20 is delimited, at the bottom, by a second bottom wall 25.

[0030] The bottom walls 24, 25 are inclined towards

respective first and second suction mouths, indicated with 26 and 27 respectively (figure 7), of the air suction plant 22, which is connected both to the lower compartment 20 through the second suction mouths 27 and to the upper compartment 23 through the first suction mouths 26, which preferably have larger dimensions.

[0031] The first bottom wall 24 divides the upper compartment 23 from the lower compartment or end 20 of the chamber 5 and is provided with a longitudinal slit 28 (figures 4 and 7), which faces the conveyor 3 along the entire longitudinal extension of the bottom wall 24.

[0032] According to an aspect of the invention, the longitudinal slit 28 is closed by a pair of flexible and elastically deformable second squeegee blades 29, which are made of a synthetic or elastomer plastic material, are arranged side by side, adjacent or overlapped, are shaped like brushes or foils and are configured to cooperate in contact, in use, with respective stems 30 (figure 8) of each one of the spindles 2 so as to be deformed by them while the spindles 2 travel through the cleaning chamber 5.

[0033] The conveyor 3 is housed inside and through the lower compartment or end 20 so as to be screened by the second squeegee blades 29 and is arranged immediately above the bottom wall 25.

[0034] The cleaning chamber 5 is also provided, on the inside, directly above the longitudinal slit 28, with at least one brush 31, which is made of a non-sparking synthetic or elastomer plastic material, is arranged parallel to the conveyor 3 and is configured to cooperate, in use, in contact with the stems 30 of each one of the spindles 2 in order to remove from them possible residues of powder paint. Preferably, the cleaning chamber 5 is separated into two adjacent parts by a partitioning wall 32 (figures 5 and 6) and, in this case, the chamber 5 houses two brushes 31, which are arranged in series aligned with one another, one for each part of the chamber 5.

[0035] The lower ends 21 of the pre-chambers 11, 12 are delimited by a third bottom wall 33 and by a fourth bottom wall 34 respectively (figure 2), which are inclined towards a respective third suction mouth 35 and fourth suction mouth 36 (figure 2) of the air suction plant 22.

[0036] The lower ends 21 of the pre-chambers 11, 12 are further crossed, in a through manner, by the conveyor 3, which is arranged immediately above the third and fourth bottom wall 33, 34.

[0037] With reference to figure 8, which shows, for the sake of simplicity, the sole slit 14, both the inlet slit 14 and the outlet slit 16 of the pre-chambers 11, 12 each comprise a first upper portion 37, which is shaped so as to reproduce a cross-size profile of the spindles 2, and a second lower portion 38, which is configured so as to receive, going through it, the conveyor 3.

[0038] In the area of the second portion 38 of the slits 14, 16, the casing 4 is provided, on the outside, with a pair of screens 39 arranged side by side, which are configured to reproduce, together, a cross-size profile of the conveyor 3.

[0039] The screens 39 are carried by the casing 4 in a transversely movable manner and so that they can be locked in a plurality of different positions by means of fastening elements 40, which are also carried by the casing 4, on the outside, so that a same casing 4 can receive, going through the pre-chambers 11, 12 and the cleaning chamber 5, conveyors 3 of different widths.

[0040] According to a further aspect of the invention, the nozzles 6 are arranged in the cleaning chamber 5 divided into two benches 41, 42 of nozzles, each bench 41, 42 of nozzles consisting of a plurality of, preferably three, vertical lines 43 (figures 1 and 7) of nozzles 6 aligned with one another, which are defined by respective straight pipes feeding the nozzles 6 of each line.

[0041] The vertical lines 43 of nozzles 6 are spaced apart from one another in a forward direction A of the conveyor 3 (indicated by the arrow in figure 1) with a predetermined pitch and the two benches 41, 42 of nozzles 6, in turn, are spaced apart from one another with one pitch in the forward direction A of the conveyor 3.

[0042] Between the two nozzle benches 41, 42 there is arranged a compressed air feeding pipe 44, which is part of the compressed air feeding plant 9 and is connected to an air manifold 45, which is arranged parallel to the conveyor 3 and on the outside of the cleaning chamber 5, on the outside of the casing 4.

[0043] Each one of the vertical lines 43 of nozzles 6 is connected in parallel to the air manifold 45 by means of first pneumatic valves 46, one for each line 43 of nozzles.

[0044] The nozzles 6 of each vertical line 43 are preferably divided into two groups by means of respective second pneumatic valves 47 (figures 1, 4 and 7), one for each line 43 of nozzles 6; the nozzles 6 of a first upper group are housed inside the compartment 23 and the ones of a second lower group of nozzles are housed in the lower compartment 20 of the cleaning chamber 5.

[0045] The upper compartment 23 is configured to house, in use, an upper portion 48 (figure 8) of the spindle 2 consisting of a head 49, which is provided with a (known) spindle centring cone, and of the stem 30, and the lower compartment or end 20 is configured to house, in use, a lower portion 50 (figure 8) of the spindles 2, which is configured in a known manner not described herein for the sake of simplicity, is suited to be coupled to the conveyor 3 and, for the reason explained below, is provided with a toothed flange 51.

[0046] According to an aspect of the invention, the second group or lower group of nozzles 6 of each vertical line 43 of nozzles 6 is configured to blow air directly above the lower portion 50 of the spindles 2 and at least one nozzle 6 of this second group or lower group of nozzles 6 of each vertical line 43 is configured to blow air directly above the toothed flange 51.

[0047] In combination with the presence of the toothed flange 51 on the spindles 2, the conveyor 3 is longitudinally provided with a stationary rack 52 (figure 8), which is configured to engage, in use, the toothed flange 51 of each spindle 2 so as to cause the spindles 2 to rotate on themselves while they move along the conveyor 3, at

least along the cleaning chamber 5 and, more in general, also while they move along the pre-chambers 11 and 12.

[0048] According to an aspect of the invention, the pitch with which the vertical lines 43 of nozzles 6 are spaced apart from one another is chosen/configured so that the first bench 41 of nozzles 6 is configured to blow compressed air on three first angular sectors S1 of the spindles 2 (the sectors S1 being schematically shown in a graphic manner for greater clarity in figure 2) during a first complete rotation of the spindles 2, whereas the second bench 42 of nozzles is configured to blow compressed air on three second annular sectors S2 (figure 2) of the spindles 2 during a second complete rotation of the spindles 2.

[0049] According to figure 2, the angular sectors S2 are adjacent to the angular sectors S1 and cover, together with them, a 360° angle (round angle), so that each spindle 2 is hit by the compressed air emitted by a vertical line 43 of nozzles 6 successively on a non-adjacent series of specific angular sectors thereof, at first (in the example shown herein) the three sectors S1 and then the three sectors S2. Obviously, the rotation of the spindles 2 must be synchronized based on the number of vertical lines 43 of nozzles 6 available.

[0050] The presence of an air feeding piping 44 inserted between the two benches 41, 42 of nozzles 6 allows the spindle to "skip one step" and make sure that, without changing the synchronization of the motion of the spindles 2 (which depends on the number of teeth of the toothed flange 51), the second bench 42 of nozzles 6 hits with its air and, consequently, cleans the sectors S2, which are alternated with the sectors S1, instead of cleaning again the sectors S1 that have already been cleaned by the bench 41 of nozzles 6.

[0051] The cleaning device 1 preferably comprises, furthermore, at least a first track 53 and a second longitudinal track 54, preferably at least a pair of lower tracks 52 and one, or a pair, of upper tracks 54.

[0052] The tracks 53 and 54 are arranged parallel to the conveyor 3 and face one another.

[0053] In particular, the second track 54 is arranged in a through manner along respective upper ends of the pre-chambers 11, 12 and of the cleaning chamber 5, said upper end being defined by the compartment 23, and the first track 53 is arranged in a through manner along the lower ends 21 of the pre-chambers 11, 12, and end 20 of the cleaning chamber 5, immediately above the conveyor 3.

[0054] The tracks 53 and 54 are configured to cooperate, in use, with the spindles 2 so as to vertically push them towards the conveyor 3 and keep the spindles 2 stable in a substantially vertical position while they cross the cleaning chamber 5 and said pre-chambers 11, 12. The tracks also allow the spindle centring cone of the heads 49 to be pressed so as to extract the powder that could deposit on the inside.

[0055] In order to do so, the pair of lower tracks 53 cooperates in a sliding manner with a disc 55 (figure 8), which is part of the lower portion 50 of each spindle 2, whereas the single track or the pair of tracks 54 cooperates in a sliding manner with the head 49 of each spindle 2, specifically with the spindle centring cone of the head 49.

[0056] The casing 4 is made of a fireproof plastic material divided into three prefabricated elements, one single upper element 4b, which is shell-shaped, and two lower elements 4c, which have the shape of a half-shell (figure 2).

[0057] From what described above, it is evident that the invention also relates to a method for cleaning painting spindles 2 used to support wheel rims while being painted, said cleaning method comprising the steps of:

- engaging a lower end or portion 50 of the spindles on a conveyor 3 configured to transport a plurality of spindles 2 arranged in sequence along a predefined trajectory;
- causing the spindles 2 to move forward in sequence through a cleaning chamber 5, where the spindles 2 are hit by jets of compressed air emitted by a plurality of nozzles 6 oriented towards the conveyor 3;
- providing, in series to the cleaning chamber 5, a first pre-chamber 11 and a second pre-chamber 12 in the area of an inlet opening 13 and outlet opening 15, respectively, of the cleaning chamber 5 and provided, in turn, with an inlet slit 14 and outlet slit 16 respectively facing the corresponding inlet and outlet openings 13, 15;
- configuring the conveyor (3) so that it crosses, in a through manner, the pre-chambers 11, 12 engaging the inlet and outlet slits 14 and 16;
- providing, on the inlet and outlet openings 13, 15, first elastically deformable squeegee blades 18, which are configured to close openings 13, 15 of the cleaning chamber 5 and to brush the spindles 2 when they cross the openings 13, 15; and creating, in the area of the inlet and outlet slits 14, 16, respective pre-chambers 11, 12 with respective air curtain seals C1,C2;
- causing the spindles 2 to rotate on themselves while they cross at least the cleaning chamber 5 and arranging the nozzles 6 in a first and a second bench 41, 42 with at least three vertical lines 43 of nozzles 6 spaced apart from one another with a pitch that is such that each line 43 of nozzles of the first bench 41 sends compressed air to first angular sectors S1 of the spindles during a first complete rotation of the spindles 2, whereas each line 43 of nozzles of the second bench 42 sends, during a second complete rotation of the spindles 2, compressed air on second angular sectors S2 of the spindles 2, which are adjacent to the first angular sectors S1 and are such that the first and second angular sectors cover 360°;
- sucking a volume of air which is greater than the one emitted by the nozzles 6 from respective lower ends 20, 21 of the cleaning chamber 5 and of the pre-

chambers 11, 12 and, at the same time, from an upper compartment 23 of the cleaning chamber 5, which is separated from the lower end 20 of the cleaning chamber 5 by an inclined wall 24, which is provided with a longitudinal slit 28, which is aligned with the conveyor 3 so as to allow for the passage of the spindles 2 and is closed by second elastically deformable squeegee blades 29, which brush respective stems 30 of the spindles 2 and screen the conveyor 3, which is arranged inside the bottom ends 20, 21 of the cleaning chamber 5 and of the pre-chambers 11, 12.

[0058] In this way, there is no risk of sparks, the brushes used, like the brush 31, only have to perform a finishing task, the cleaning being mainly carried out by the nozzles 6 by means of compressed air, which is then sucked in a much greater quantity than the air introduced, so as to keep the inside of the chambers 5, 11 and 12 under vacuum, the air sucked by the plant 22 being compensated by the inlet of ambient air, since the chambers 11, 12 and 5 are not airtight.

[0059] These solutions lead to a perfect cleaning of the spindles 2, on all parts thereof, and there is no risk of powder paint being released into the atmosphere, thus reducing pollution and explosion risks to zero.

[0060] Hence, all the objects of the invention are reached.

Claims

1. A cleaning device (1) for painting spindles (2) for the support of wheel rims, the cleaning device comprising a conveyor (3) configured to engage and transport a plurality of spindles arranged in sequence along a predefined direction (A), a casing (4) delimiting a cleaning chamber (5) through which said conveyor is arranged so that, in use, said spindles travel in sequence along said predefined direction (A) through the cleaning chamber, a plurality of nozzles (6) arranged inside the cleaning chamber (5) and orientated towards said conveyor, and a compressed air feeding plant (9) for feeding compressed air to said nozzles; **characterized in that,** in combination:

   - the device comprises a first (11) and a second (12) pre-chamber delimited by said casing (4) and arranged in series to the cleaning chamber (5), the pre-chambers being crossed in series by the conveyor (3),
   - the first pre-chamber (11) being arranged at an inlet opening (13) of the cleaning chamber with which it is in hydraulic communication and being provided in turn with an inlet slit (14) crossed by the conveyor;
   - the second pre-chamber (12) being arranged at an outlet opening (15) of the cleaning chamber with which it is in hydraulic communication and being provided in turn with an outlet slit (16) crossed by the conveyor;
   - the inlet and outlet openings (13,15) of the cleaning chamber being each closed by a pair of flexible and elastically deformable first squeegee blades (18) made of a synthetic or elastomeric plastic material and arranged side-by-side, adjacent or overlapped and shaped like brushes or foils, configured to cooperate in contact with each of said spindles in order to be deformed by them while the spindles cross the inlet and outlet openings and to brush the spindles at the same time;
   - the inlet and outlet slits (14,16) of the pre-chambers being provided each with a respective air curtain double seal (C1,C2); and
   - said cleaning chamber (5) and said first and second pre-chamber (11,12) being connected, at their respective bottom ends (20,21), to an air suction plant (22).

2. The cleaning device according to claim 1, **characterized in that** said cleaning chamber (5) is divided into an upper compartment (23) and a lower compartment (20) defined by said respective bottom end thereof; the upper compartment (23) being delimited at the bottom by a respective first bottom wall (24) and the lower compartment (20) being delimited at the bottom by a second bottom wall (25) and defining said bottom end (20) of the cleaning chamber (5); said first and second bottom walls (24,25) being inclined towards respective first and second suction mouths (26,27) of the air suction system, which is connected to both the lower compartment (20) through the second suction mouths (27), and to the upper compartment (23) through the first suction mouths (26), the first bottom wall (24) dividing the upper compartment from the lower compartment and being provided with a longitudinal slit (28) facing said conveyor for an entire longitudinal extension of the first bottom wall; said longitudinal slit (28) being closed by a pair of flexible and elastically deformable second squeegee blades (29) made of a synthetic or elastomeric plastic material and arranged side-by-side, adjacent or overlapped and shaped like brushes or foils, configured to cooperate in contact, in use, with respective stems (30) of each of said spindles to be deformed by them while the spindles pass through said cleaning chamber; said conveyor (3) being housed through the lower compartment (20) so as to be screened by the second squeegee blades (29) and being arranged immediately above the second bottom wall (25).

3. The cleaning device according to claim 2, **characterized in that** the cleaning chamber (5) is internally

provided, directly above said longitudinal slit (29) of the first bottom wall, with a brush (31) made of a non-sparking synthetic or elastomeric plastic material arranged parallel to said conveyor (3) and configured to cooperate in use in contact with the stems (30) of each of said spindles to remove from them any residues of powder paint.

4. The cleaning device according to one of the preceding claims, **characterized in that** the bottom ends (20,21) of said first and second pre-chambers (11,12) are delimited, respectively, by a third (33) and a fourth (34) bottom wall, which are inclined towards a respective third and fourth suction mouth (35,36) of the air suction plant, the lower ends (21) of the pre-chambers being crossed through by said conveyor, which is arranged immediately above the third and fourth bottom wall.

5. The cleaning device according to one of the preceding claims, **characterized in that** said inlet slits (14) and outlet slits (16) of the pre-chambers each comprise a first upper portion (48), shaped so as to reproduce a transverse overall profile of the spindles, and a second lower portion (50), configured to receive said conveyor, passing through it; at the second portion (50) of the inlet and outlet slits of the pre-chambers the casing being externally provided with a pair of side-by-side screens (39) configured to reproduce between them a transverse overall profile of the conveyor; said screens (39) being carried by the casing (4) transversally movable and fastenable in a plurality of different positions by means of fastening elements (40) also carried externally by the casing, so that the same casing (4) is adapted to receive, through said pre-chambers and said cleaning chamber, conveyors of different widths.

6. The cleaning device according to one of the preceding claims, **characterized in that** said plurality of nozzles (6) are arranged in the cleaning chamber divided into two nozzle benches (41,42); each nozzle bench being composed of a plurality, preferably three, of vertical lines (43) of nozzles aligned with one another; the vertical lines of nozzles being spaced from one another in a forward direction of the conveyor with a predefined pitch and the two nozzle benches (41,42) being in turn spaced from each other with a same pitch in the forward direction of the conveyor, a compressed air feeding piping (44) forming part of said compressed air feeding plant being arranged between the two nozzle benches and is connected to an air manifold (45) arranged parallel to the conveyor and outside said cleaning chamber, each of said vertical lines of nozzles (43) being connected in parallel to the air manifold by means of first pneumatic valves (46), one for each line of nozzles.

7. The cleaning device according to claim 6, **characterized in that** the nozzles (6) of each of said vertical lines of nozzles (43) are separated into two groups by means of respective second pneumatic valves (47), one for each line of nozzles; the first groups of nozzles (6) being housed in an upper compartment (23) of the cleaning chamber and the second groups of nozzles (6) being housed in a lower compartment (20) of the cleaning chamber, the upper and lower compartments being separated from each other by an inclined bottom wall (24) of the upper compartment; the upper compartment (23) being configured to house in use an upper portion (48) of said spindles composed of a head (49) and a stem (30), and the lower compartment (20) being configured to house in use a lower portion (50) of said spindles configured to couple with the conveyor and provided with a toothed flange (51); the second group of nozzles (6) being configured to blow air directly above said lower portion of the spindles and at least one nozzle of the second group of nozzles being configured to blow air directly above said toothed flange.

8. The cleaning device according to claim 6 or 7, **characterized in that** the conveyor (3) is provided longitudinally with a stationary rack (52) configured to engage in use the toothed flange (51) of each spindle to cause the spindles to rotate on themselves while they move forward along the conveyor, at least along the cleaning chamber; said pitch at which the vertical lines of nozzles (43) are spaced from one another being chosen so that the first nozzle bench (41) is configured to blow compressed air on three first angular sectors (S1) of the spindles during a first complete rotation thereof, while said second nozzle bench (42) is configured to blow compressed air on three second angular sectors (S2) of the spindles during a second complete rotation thereof; the second angular sectors being adjacent to the first angular sectors and covering together with the latter an angle of 360° (round angle).

9. The cleaning device according to one of the preceding claims, **characterized in that** it comprises at least one first and one second longitudinal track (53,54), arranged parallel to the conveyor; the first and second tracks being arranged facing each other, the second track (54) being arranged passing along respective upper ends of the pre-chambers (11,12) and of the cleaning chamber (5) and the first track (53) being arranged passing along said bottom ends (21,20) of the pre-chambers and of the cleaning chamber, immediately above the conveyor; the first and second tracks (53,54) being configured to cooperate in use with the spindles to push them vertically towards the conveyor (3) and maintain the spindles stable in a substantially vertical position while they cross the cleaning chamber and said pre-cham-

bers.

10. A method for cleaning painting spindles (2) for the support of wheel rims, the method comprising the steps of:

- engaging a lower end (50) of the spindles on a conveyor (3) configured to transport a plurality of spindles arranged in sequence along a predefined trajectory;
- causing the spindles to move forward in sequence through a cleaning chamber (5) where the spindles are hit by jets of compressed air emitted by a plurality of nozzles (6) orientated towards the conveyor; **characterised in that it further comprises the steps of:**

i)- arranging in series to the cleaning chamber a first and a second pre-chamber (11,12) at an inlet opening (13) and outlet opening (15) respectively of the cleaning chamber and provided in turn with an inlet slit (14) and outlet slit (16) respectively facing the corresponding inlet and outlet openings;
ii)- configuring the conveyor (3) so that it crosses through the pre-chambers engaging said inlet and outlet slits;
iii)- arranging on the inlet and outlet openings first elastically deformable squeegee blades (18) configured to close said openings of the cleaning chamber and to brush the spindles when they cross said openings and create at the inlet and outlet slits of the pre-chambers respective air curtain seal (C1,C2);
iv)- causing the spindles to rotate on themselves while they cross at least the cleaning chamber (5) and arranging the nozzles (6) in a first and a second bench (41,42) of at least three vertical lines of nozzles (43) spaced from one another with a pitch such that each line of nozzles of the first bench (41) sends compressed air to first angular sectors (S1) of the spindles during a first complete rotation of the spindles, while each line (43) of nozzles of the second bench (42) sends, during a second complete rotation of the spindles, compressed air on second angular sectors (S2) of the spindles adjacent to the first angular sectors and such that the first and second angular sectors cover 360°;
v)- sucking a volume of air greater than that emitted by the nozzles from respective bottom ends (20,21) of the cleaning chamber and the pre-chambers and from an upper compartment (23) of the cleaning chamber divided from the bottom end of the cleaning chamber by an inclined wall (24) provided with a longitudinal slit (28) aligned with the conveyor to allow the passage of the spindles and closed by second elastically deformable squeegee blades (29) that brush respective stems of the spindles and screen the conveyor, which is arranged inside the bottom ends of the cleaning chamber and the pre-chambers.

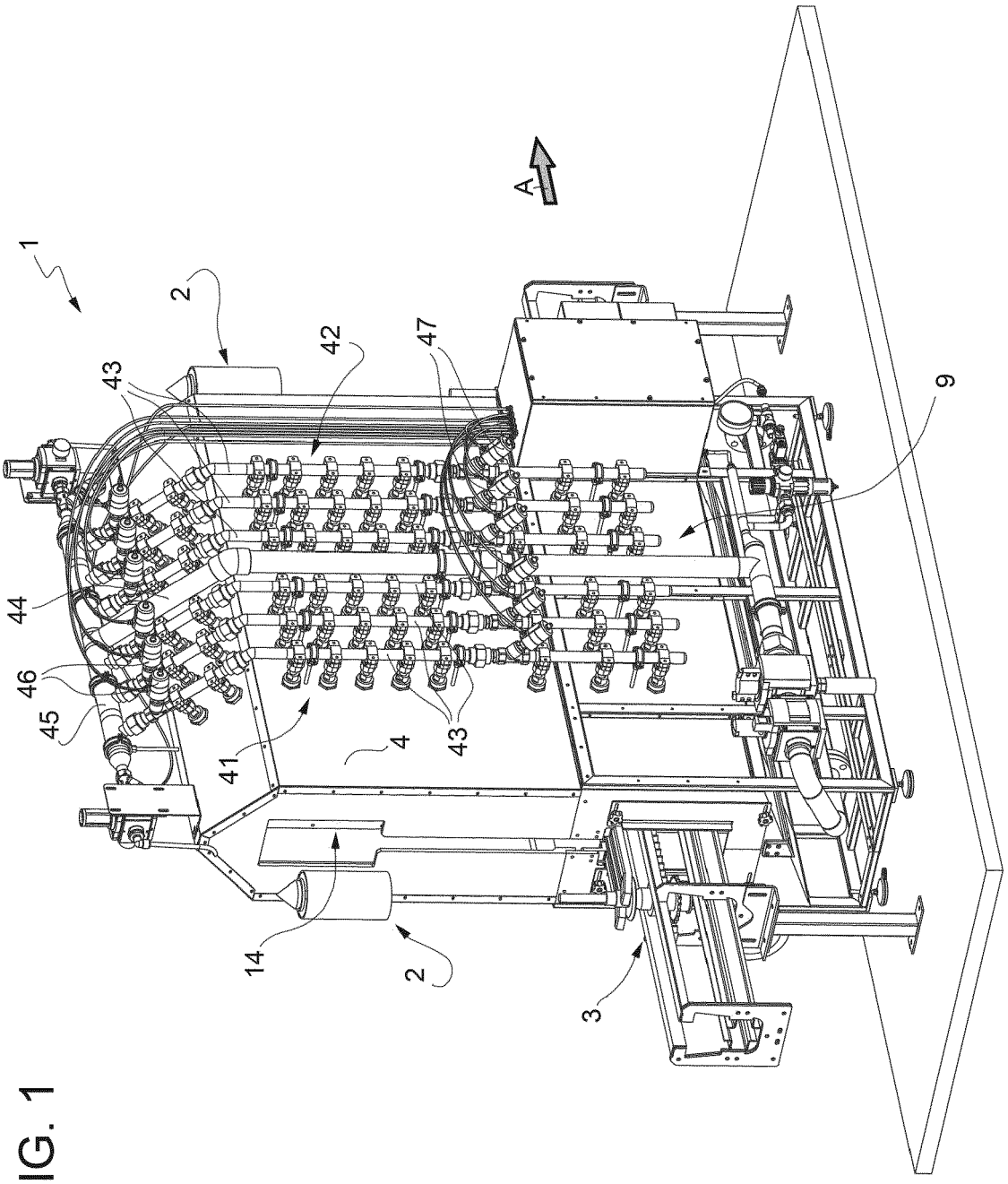


FIG. 1

FIG. 2

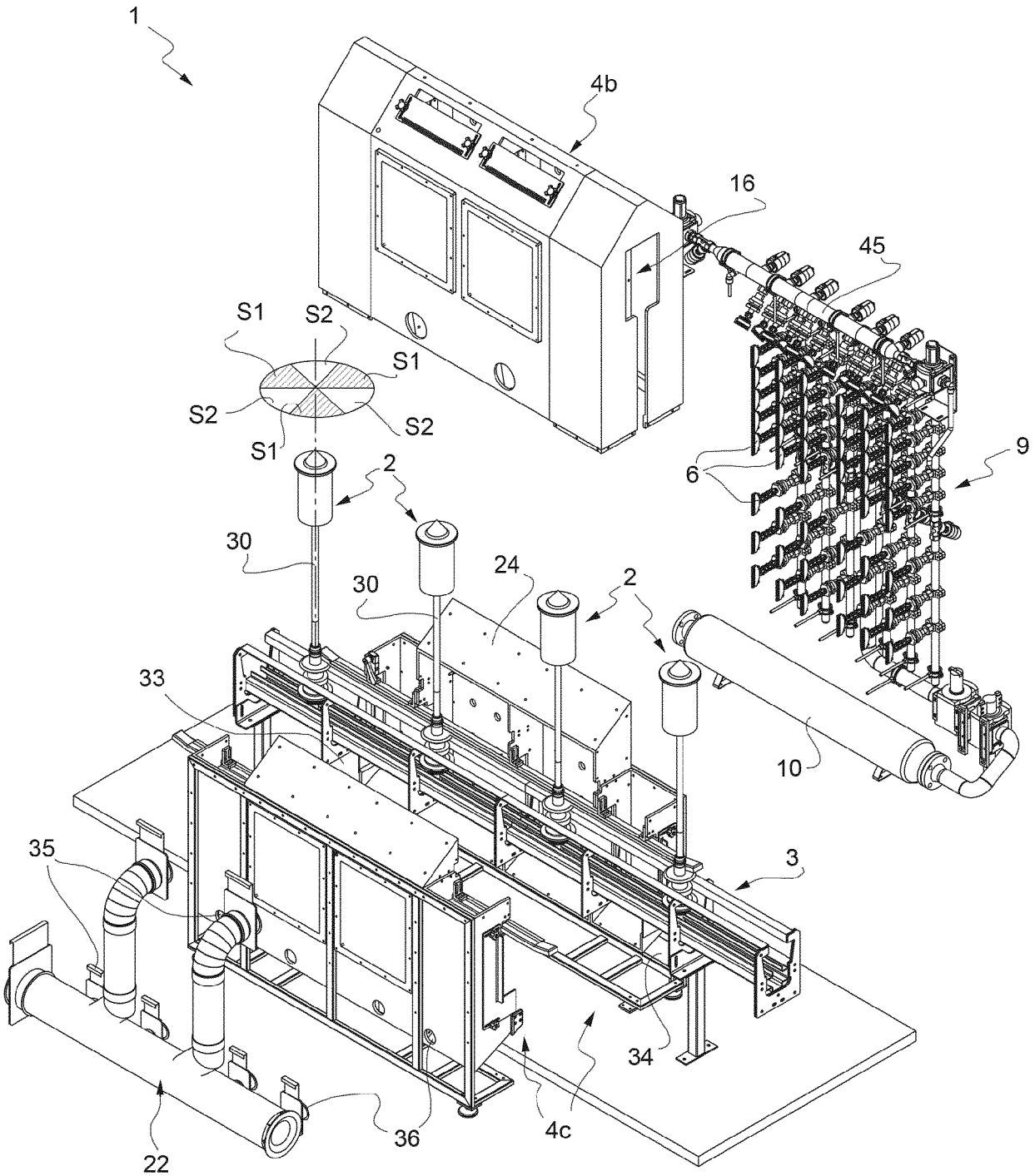


FIG. 3

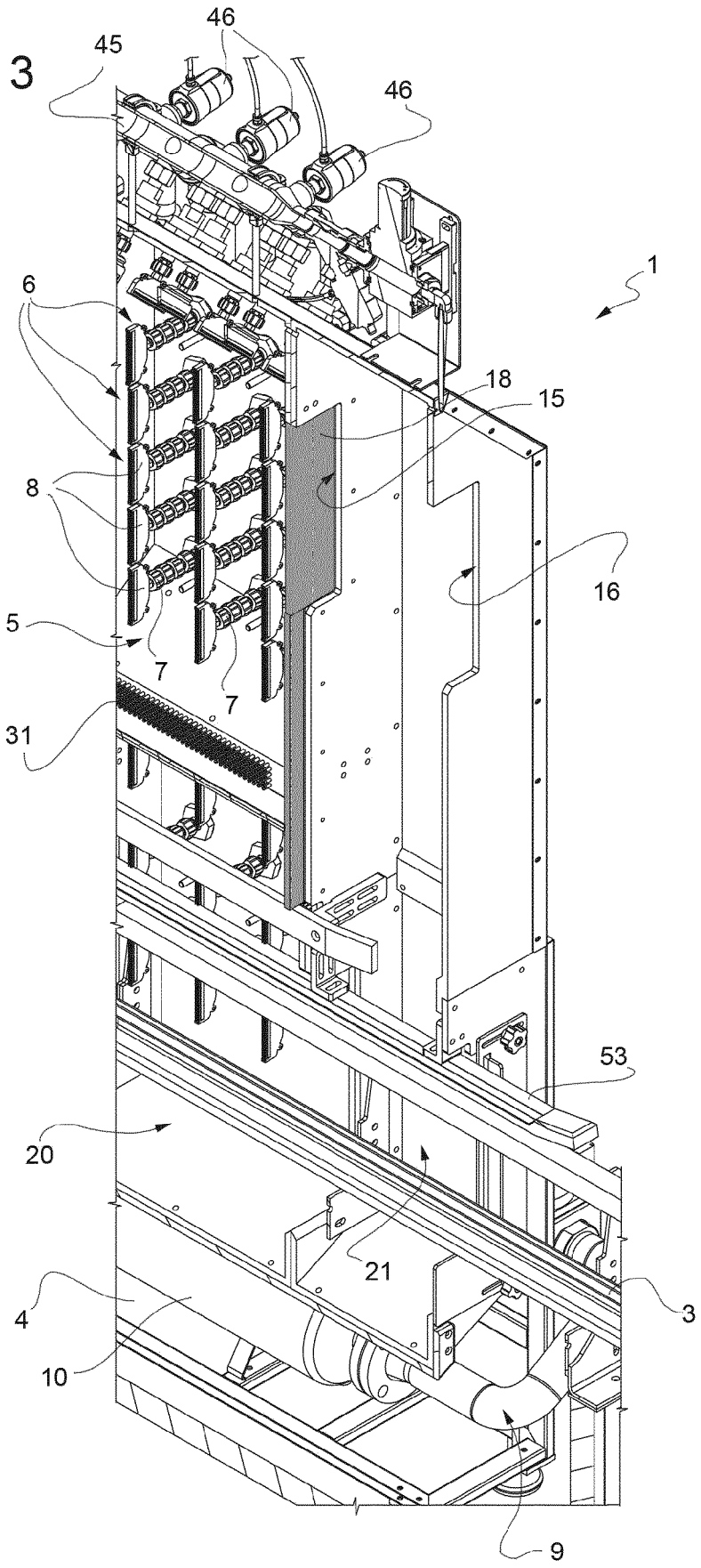
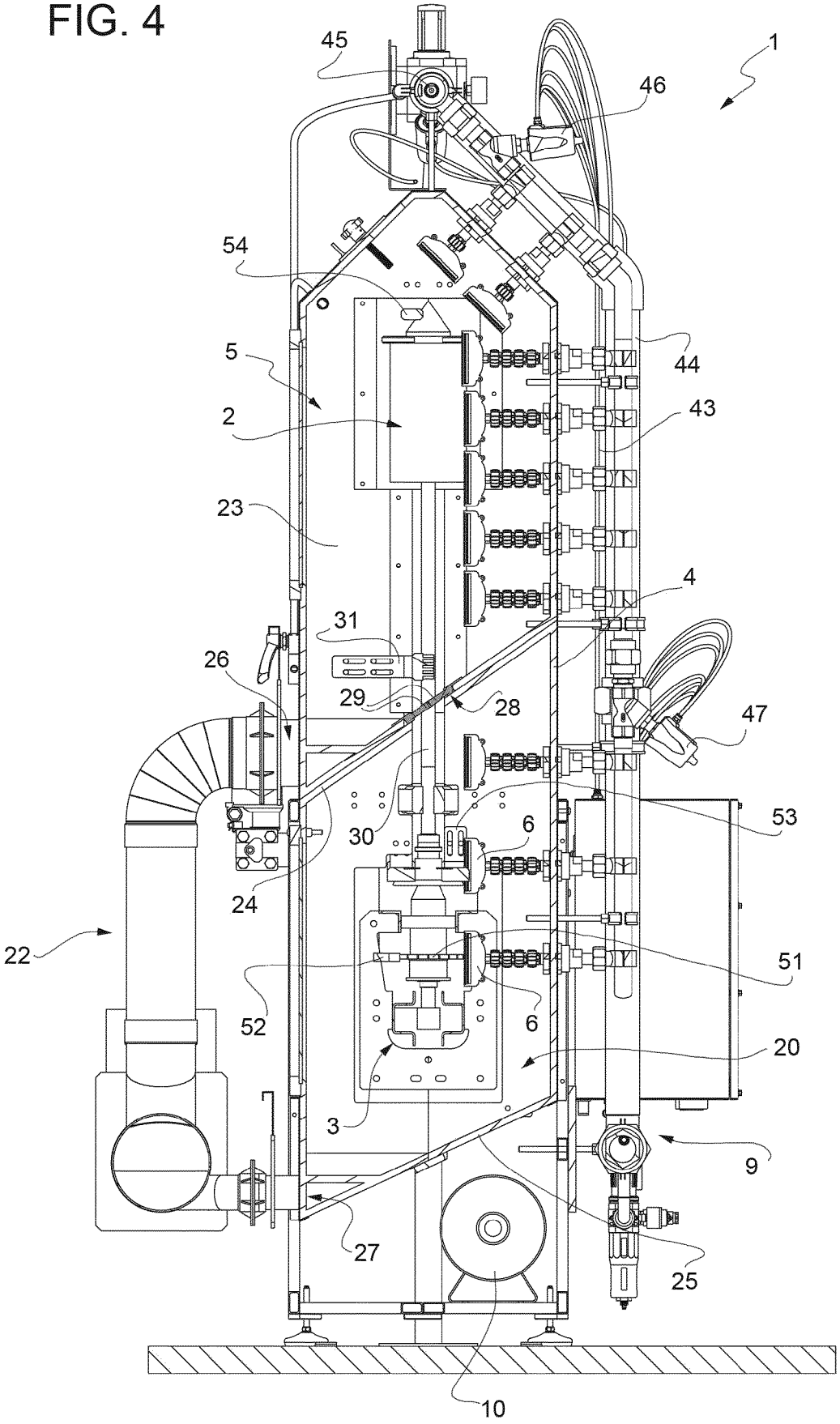


FIG. 4


45
1
46
54
5
44
2
43
23
4
31
26
29
28
47
53
30
6
24
22
51
52
6
20
3
9
27
25
10

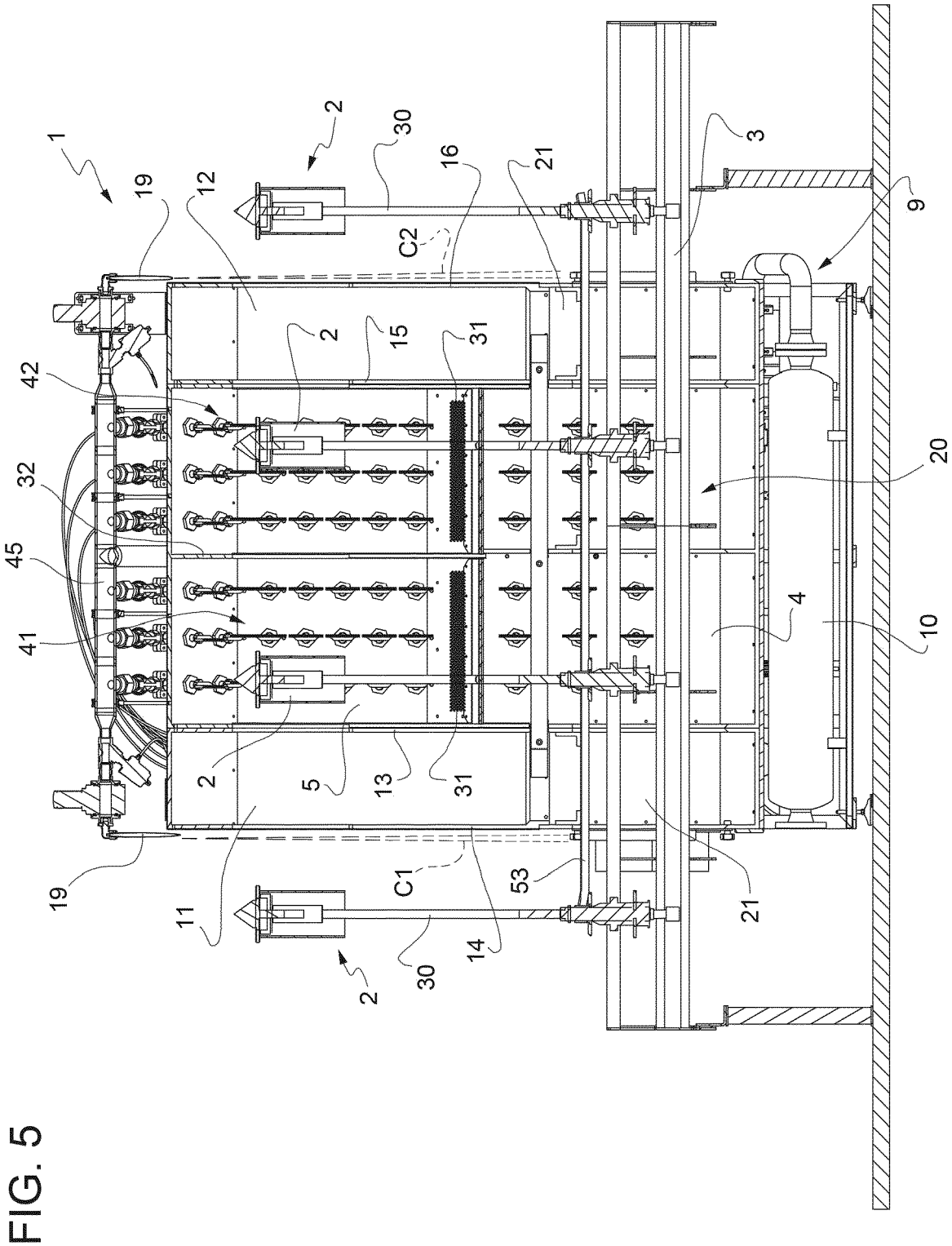

1
19
12
2
30
16
21
3
9
C2
2
15
31
42
32
45
41
20
4
10
2
5
13
31
19
11
C1
53
21
14
30
2

FIG. 5

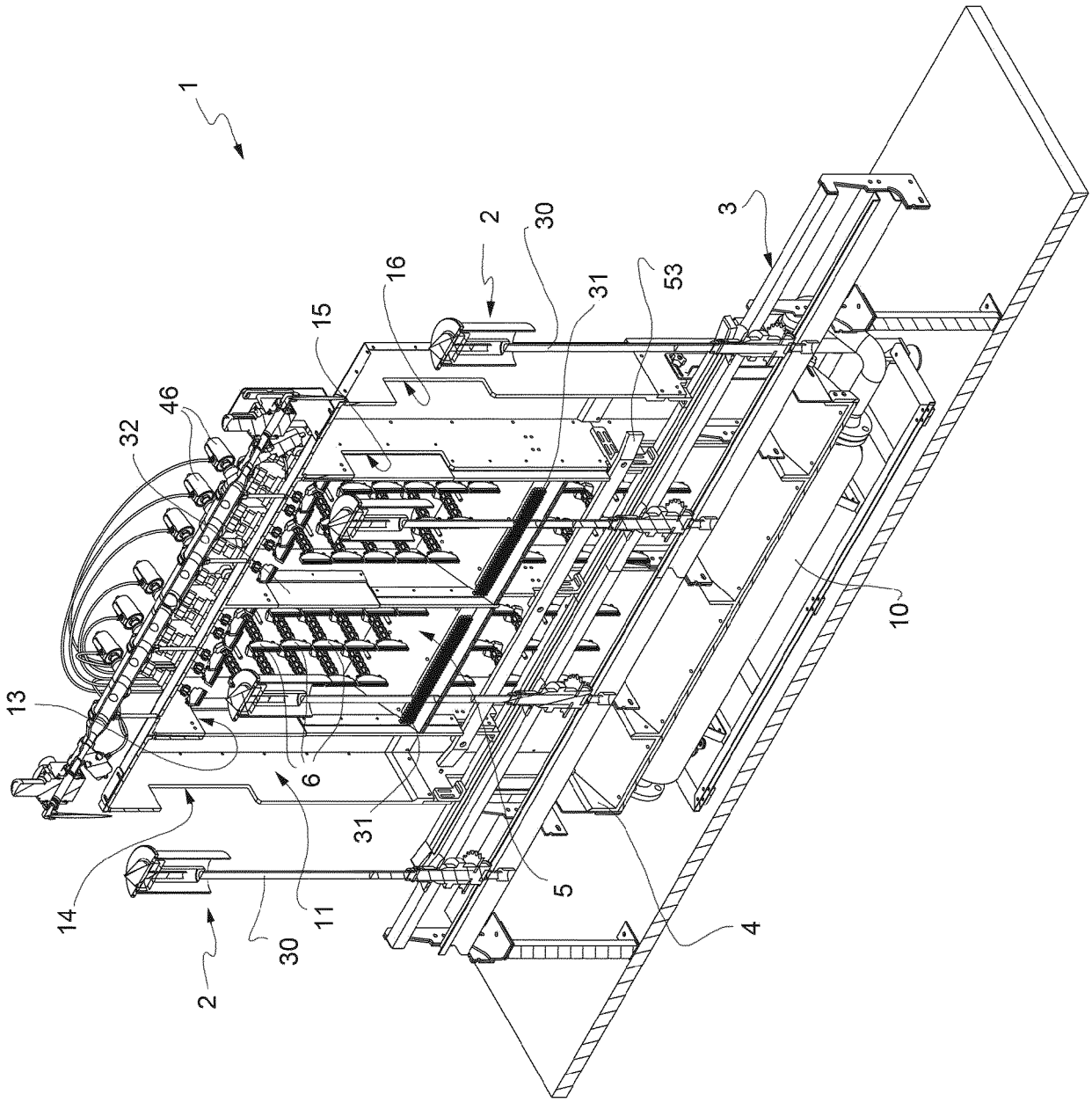


FIG. 6

FIG. 7

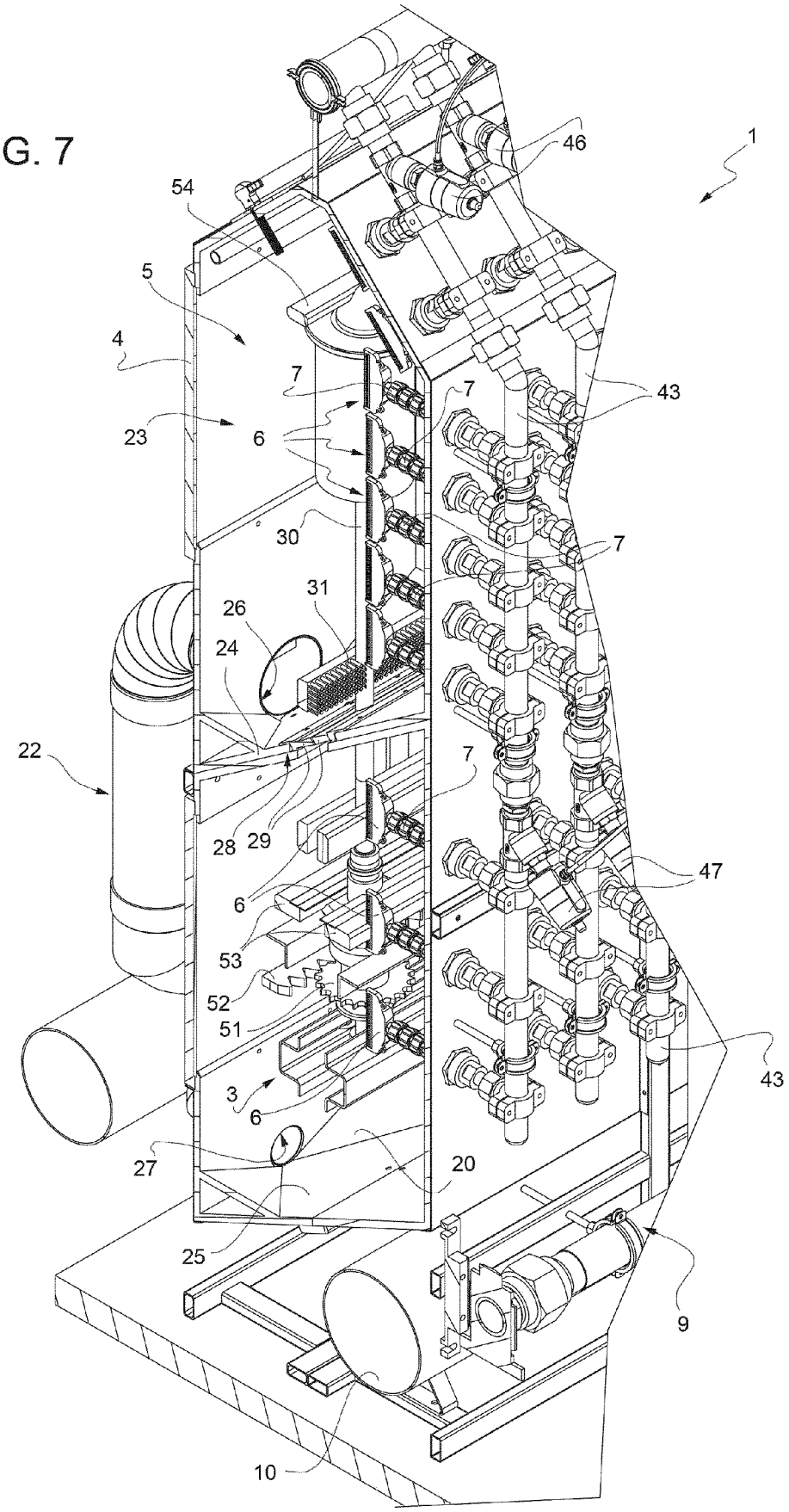
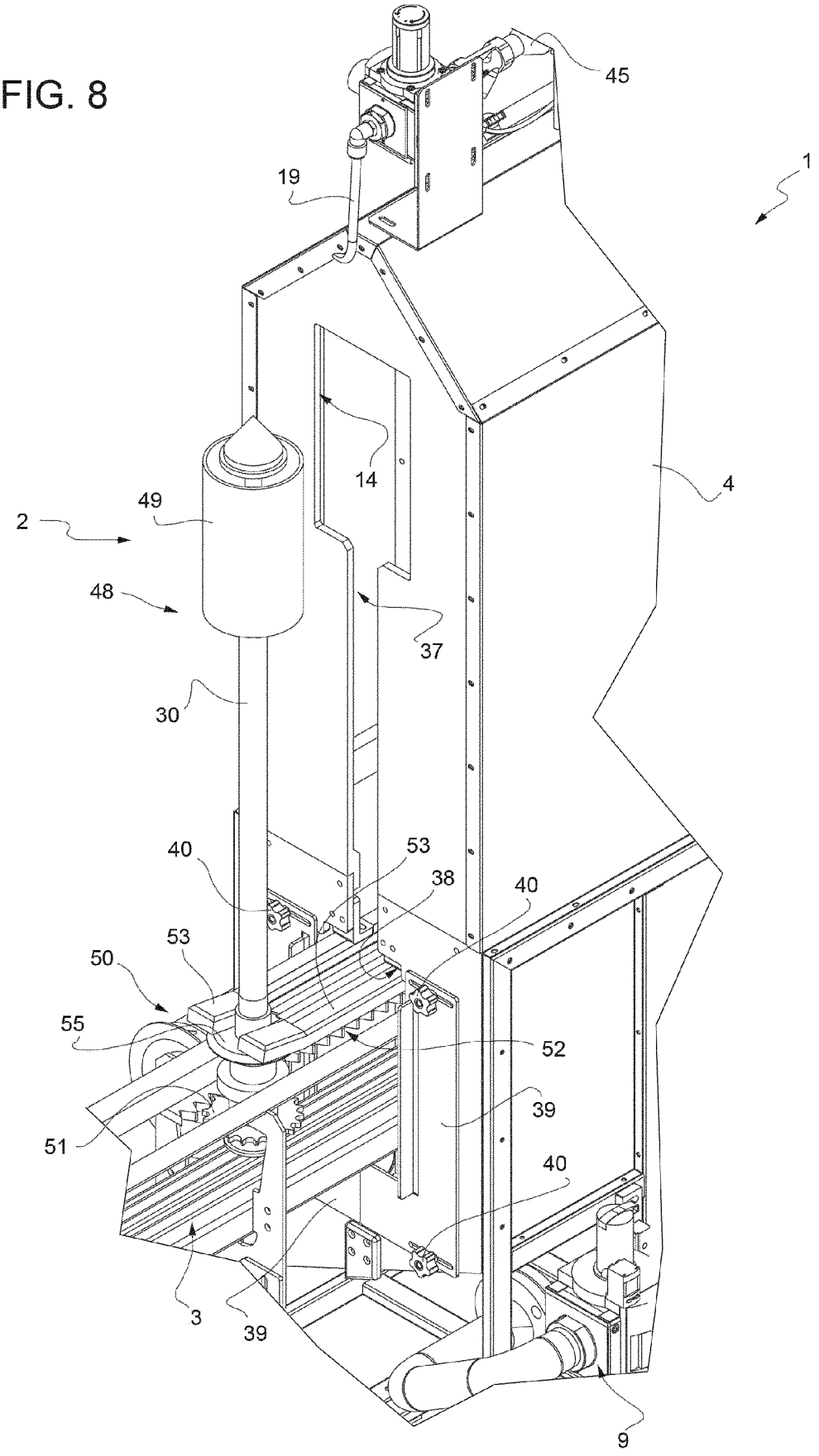


FIG. 8



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 20 17 9834

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	WO 01/53000 A2 (WURSTER GERD [DE]) 26 July 2001 (2001-07-26)	1	INV. B08B5/02
A	* abstract * * page 1, line 1 - page 3, line 4 * * page 16, line 18 - page 23, line 8 * * claims * * figures *	2-7,10	B05B14/10 B65G45/22

Y	DE 10 2016 103941 A1 (BRIDGEWATER SIMEITIS GBR (VERTRETUNGSBERECHTIGTE GESELLSCHAFTER: KENT) 7 September 2017 (2017-09-07)	1	
A	* abstract * * paragraph [0001] * * paragraph [0022] - paragraph [0023] * * paragraph [0040] - paragraph [0047] * * paragraph [0055] * * claims * * figures *	2,10	

A	US 3 837 037 A (WRIGHT G) 24 September 1974 (1974-09-24) * abstract * * column 1, line 7 - line 19 * * column 3, line 26 - line 39 * * column 4, line 16 - line 49 * * claims * * figures *	1,6-10	TECHNICAL FIELDS SEARCHED (IPC) B08B B05B B65G F26B

A	DE 10 2010 032143 A1 (EISENMANN AG [DE]) 26 January 2012 (2012-01-26) * abstract * * paragraph [0001] - paragraph [0003] * * paragraph [0038] - paragraph [0048] * * claims * * figures *	1,10	

	-/--		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 October 2020	van der Zee, Willem

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 20 17 9834

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GB 1 543 439 A (COPE WHELON AND COMPANY LIMITED) 4 April 1979 (1979-04-04) * page 1, line 10 - line 14 * * page 1, line 90 - page 2, line 57 * * claims * * figures * -----	1,10	

TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 October 2020	van der Zee, Willem

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 17 9834

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

05-10-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0153000 A2	26-07-2001	AT 313386 T	15-01-2006
		AU 4052201 A	31-07-2001
		EP 1248683 A2	16-10-2002
		WO 0153000 A2	26-07-2001
DE 102016103941 A1	07-09-2017	NONE	
US 3837037 A	24-09-1974	NONE	
DE 102010032143 A1	26-01-2012	BR 112013001147 A2	17-05-2016
		CN 102892515 A	23-01-2013
		DE 102010032143 A1	26-01-2012
		EP 2595761 A1	29-05-2013
		RU 2012154559 A	27-08-2014
		WO 2012016637 A1	09-02-2012
GB 1543439 A	04-04-1979	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- IT 102019000009030 **[0001]**